

(19) World Intellectual Property
Organization
International Bureau



(43) International Publication Date
6 January 2005 (06.01.2005)

PCT

(10) International Publication Number
WO 2005/000746 A1

(51) International Patent Classification⁷: C02F 1/00,
B01D 47/02, 53/14

(21) International Application Number:
PCT/NO2004/000187

(22) International Filing Date: 24 June 2004 (24.06.2004)

(25) Filing Language: Norwegian

(26) Publication Language: English

(30) Priority Data:
2003 2985 27 June 2003 (27.06.2003) NO

(71) Applicant (for all designated States except US): SIN-
VENT AS [—/NO]; N-7065 Trondheim (NO).

(72) Inventors; and

(75) Inventors/Applicants (for US only): SKJETNE, Tore
[NO/NO]; Sunnlandsskrenten 32, N-7032 Trondheim
(NO). LARSEN, Roar [NO/NO]; Humlehaugv. 1,
N-7054 Ranheim (NO). LUND, Are [NO/NO]; Sil-
dråpeveien 23D, N-7048 Trondheim (NO).

(74) Agent: BRYN AARFLOT AS; P.O. Box 449 Sentrum,
Kongensgate 15, N-0104 Oslo (NO).

(81) Designated States (unless otherwise indicated, for every
kind of national protection available): AE, AG, AL, AM,
AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN,
CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI,
GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE,
KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD,
MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG,
PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM,
TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM,
ZW.

(84) Designated States (unless otherwise indicated, for every
kind of regional protection available): ARIPO (BW, GH,
GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM,
ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM),
European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI,
FR, GB, GR, HU, IE, IT, LU, MC, NL, PL, PT, RO, SE, SI,
SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ,
GW, ML, MR, NE, SN, TD, TG).

Published:

- with international search report
- before the expiration of the time limit for amending the
claims and to be republished in the event of receipt of
amendments

For two-letter codes and other abbreviations, refer to the "Guid-
ance Notes on Codes and Abbreviations" appearing at the begin-
ning of each regular issue of the PCT Gazette.

(54) Title: METHOD AND DEVICE FOR PURIFICATION OF AIR AND WATER

(57) Abstract: The present invention concerns a method for purification of contaminated water through hydrate formation and separation of hydrates from contaminated water enriched with contaminants, by supplying hydrate particles to the water during hydrate formation. The present invention also concerns a device for purification of water by using a method according to the invention, and water produced according to the invention. By using the process principles according to the present invention, all types of water can be purified for consumption or safe discharge, or desired resources can be recovered, and air can be purified if it first is bubbled through the water which then is purified by a method according to the invention.

WO 2005/000746 A1

BEST AVAILABLE COPY

Method and device for purification of air and water

The present invention concerns a method and a device for purification of water or air/gas, and water and air/gas purified according to the invention.

Background

5 The need for purification of water can arise in different connections. The purpose can be to provide pure drinking water for consumption, to prevent spill of water soluble or water transported contaminants, to get legal effluents from an industrial process, or to obtain desired components contained in the water, but in concentrations which are too low for general recovery. Primary there are two main
10 groups of water purification; either for production of pure water or for recovery of substances which can be dissolved in the water. Different methods exist for purification of water; filtration, distillation, centrifugation, etc. Many methods are excellent for certain contaminants, but are ineffective for others. Only a few methods are good for all types of water soluble contents.

15 In connection with recovery of oil, it is a well known problem that also a water phase is produced. This water phase will be contaminated with, among others, hydrocarbons and salts. If this water, also called the "formation water", "produced water" or "production water", is dumped into the environment, in the sea or onshore, it will lead to a big contamination problem. Consequently it will be
20 of importance to purify the water before it is dumped. One alternative is reinjection of the water into the reservoir, but this will entail a cost limiting factor for the oil recovery by the very fact that there is a limitary factor as to how much oil which can be recovered from a reservoir if all of the produced water is reinjected.

 In Norway it has been decided that after 2005 no effluent in the form of
25 production water will be admitted. This means that the only effluent from the process will be pure water. Natural effluents from sediments will occur, but this fact is not taken into consideration here. The Norwegian requirement as to effluent has brought into focus the continuous increasing production of water from Norwegian oil wells.

30 There is a difference between a requirement of zero effluent in the sense of 0 ppm of anything, and zero harmful effluent. The latter means that a certain amount of substances up to a limit value of concentration and/or total amount and/or together with certain other compounds etc. might be acceptable. There exists many parameters in connection with harmfulness and many of these are